

Past-paper walk-through

The microscope in cell studies ■ 1.1

eXercise

Questions in this set

- 9700/11 N25 Q1 ■ 1 mark
- 9700/12 N25 Q1 ■ 1 mark
- 9700/13 N25 Q1 ■ 1 mark
- 9700/14 N25 Q1 ■ 1 mark
- 9700/14 N25 Q2 ■ 1 mark
- 9700/33 N25 Q2 ■ 20 marks
- 9700/34 N25 Q2 ■ 19 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 1

9700/11 N25 ■ Q1 ■ 1 mark

- 1 In a photomicrograph of magnification $\times 5000$, a chloroplast measures 25 mm in diameter.

What is the actual diameter of the chloroplast?

- A** 0.2 μm **B** 0.5 μm **C** 2 μm **D** 5 μm

Solution 1

Answer: **D**

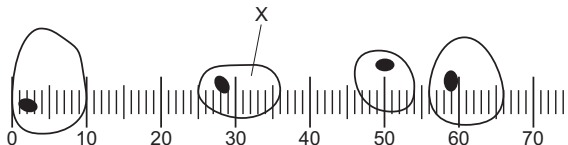
Why

- Actual size = image size $\div$ magnification.
- $25 \text{ mm} \div 5000 = 0.005 \text{ mm}$.
- 0.005 mm is $5 \mu\text{m}$.

Question 1

9700/12 N25 ■ Q1 ■ 1 mark

- 1 A student observed some cells using a microscope with an eyepiece graticule.



They then replaced the slide containing the cells with a stage micrometer with a millimetre scale, and lined up the eyepiece graticule as shown.



Question 1



What is the maximum diameter of the cell labelled X?

- A** $0.0066\text{ }\mu\text{m}$ **B** $66\text{ }\mu\text{m}$ **C** $73\text{ }\mu\text{m}$ **D** $733\text{ }\mu\text{m}$

Solution 1

Answer: **C**

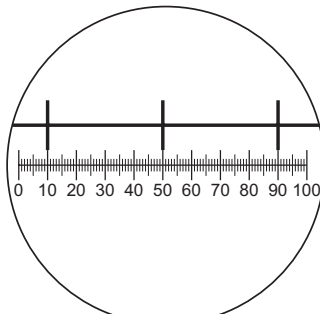
Why

- Calibrate the eyepiece graticule first, using the stage micrometer.
- Work out how many micrometres one graticule division represents.
- Then multiply by the number of divisions the cell covers.

Question 1

9700/13 N25 ■ Q1 ■ 1 mark

- 1 The diagram shows a stage micrometer, with divisions 0.1 mm apart, viewed through an eyepiece containing a graticule.



Question 1



The same eyepiece is now used to examine a blood smear.

How many graticule divisions will cover the diameter of a lymphocyte of $10\text{ }\mu\text{m}$?

A 1

B 4

C 10

D 20

Solution 1

Answer: **B**

Why

- Calibrate the graticule first: line it up against the 0.1 mm stage micrometer divisions.
- Here 40 graticule divisions span 0.1 mm = 100 μm , so one division is 2.5 μm .
- A 10 μm lymphocyte therefore covers $10/2.5 = 4$ divisions.

Question 1

9700/14 N25 ■ Q1 ■ 1 mark

- 1 Which structures are visible in an appropriately stained plant cell using a high power ($\times 400$) light microscope?

	centrioles	mitochondria	starch grains
A	✓	✗	✓
B	✓	✗	✗
C	✗	✓	✗
D	✗	✓	✓

key

✓ = visible

✗ = **not** visible

Solution 1

Answer: **D**

Why

- A light microscope at $\times 400$ resolves down to about $0.2\ \mu\text{m}$.
- Starch grains and mitochondria are large enough to be seen when stained.
- Centrioles are far too small, and higher plants do not have them anyway.

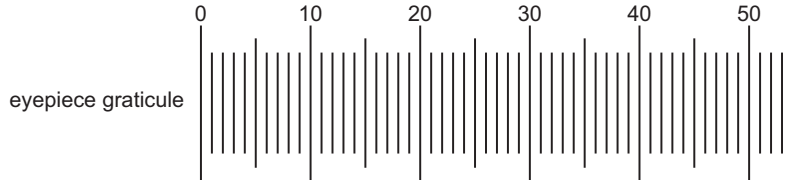
Question 2

9700/14 N25 ■ Q2 ■ 1 mark

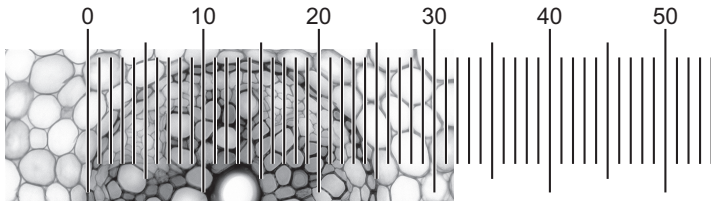
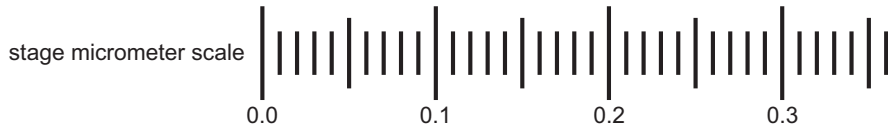
- 2** The images show an eyepiece graticule and a stage micrometer scale viewed through a microscope.

The smallest divisions of the stage micrometer scale are 0.01 mm.

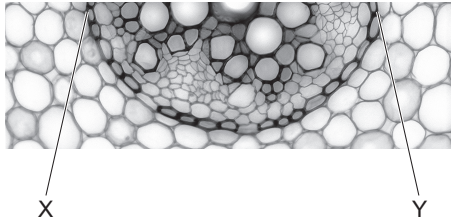
The images also show a photomicrograph of a transverse section through a plant root using the same eyepiece graticule and the same magnification.



Question 2



Question 2



What is the actual width of the vascular tissue in the plant root between X and Y?

- A** 17 μm **B** 25 μm **C** 170 μm **D** 250 μm

Solution 2

Answer: **C**

Why

- Calibrate the graticule against the stage micrometer, whose divisions are $0.01 \text{ mm} = 10 \text{ }\mu\text{m}$.
- Work out the size of one graticule division in micrometres.
- Then multiply by the number of divisions the structure spans – the magnification is unchanged between the two images.

Question 2

9700/33 N25 ■ Q2 ■ 20 marks

2 **K1** is a slide of a stained transverse section through a root.

- (a) (i)** Draw a large plan diagram of the region on **K1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

Use **one** ruled label line and the label **T** to identify a tissue involved in transport of substances throughout the plant.

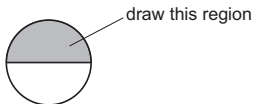


Fig. 2.1

Question 2

Question 2

[5]

- (ii) Observe the cells in the centre of the root on **K1**.

Select a group of **four** adjacent cells.

Each cell must touch at least **one** of the other cells.

Make a large drawing of this group of **four** cells.

Question 2

[4]

- (b) Fig. 2.2 is a photomicrograph of a stained transverse section through the root of a different plant to **K1**.

One difference between the section in Fig. 2.2 and the section on **K1** has been labelled.

Identify **three** other observable differences between the section in Fig. 2.2 and the section on **K1**.

Draw **three** label lines on Fig. 2.2 to label the **three** differences you have identified. You should complete the labels to describe the differences you observe.

Question 2



Question 2



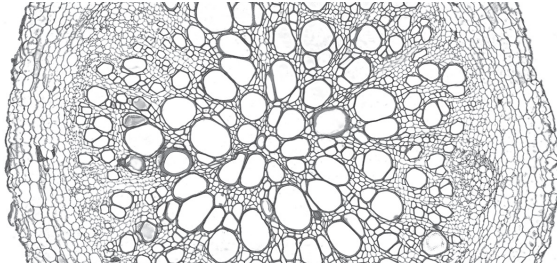
Question 2

the cortex —



Question 2

smaller in
Fig. 2.2 than
on **K1**



Question 2



Question 2

Question 2

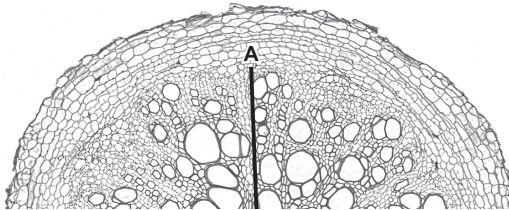
magnification $\times 35$

Fig. 2.2

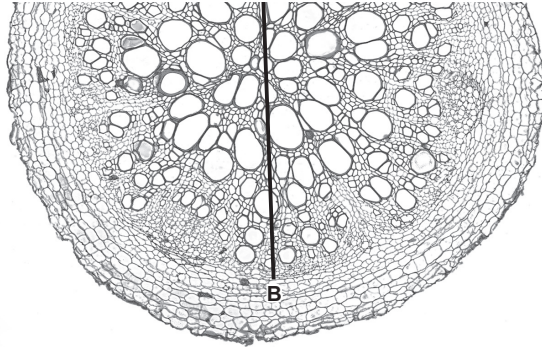
[4]

- (c) A student was asked to find the area of the vascular tissue in a transverse section of root.

The student grew one plant for three weeks and took a section from one of the roots. This section is shown in Fig. 2.3.



Question 2



magnification $\times 35$

Fig. 2.3

Question 2

The vascular tissue is the central region of the section.

Assume that the vascular tissue is a circle. The line **A–B** is the diameter of the vascular tissue.

- (i) Calculate the actual area of the vascular tissue.

Use the formula: $\text{area} = \pi r^2$, where $\pi = 3.14$.

Question 2

[4]

- (ii) The student wrote a hypothesis which stated that:

The area of vascular tissue in a root section changes as the plant grows.

Suggest modifications to the method used in (c) to investigate this hypothesis.

Question 2

[Total: 20]

Solution 2

(a)(i) Mark scheme

- 1
- uses most of the available space and the correct number of tissues ;
- 2
- draws half the root and no cells ;
- 3
- draws the outer region of the vascular tissue as 2 lines drawn close together ;
- 4
- draws the correct proportion of the vascular tissue ;

Solution 2

- 5
- label line to the tissue involved in transport of substances throughout the plant and the label T ;
- 5

Solution 2

(a)(ii) Mark scheme

- 1
- lines continuous, thin and sharp and no shading ;
- 2
- draws only four cells and each cell touching at least one of the other cells ;
- 3
- cell wall drawn as two lines ;
- 4
- correct shapes of the cells ;

Solution 2

■ 4

Solution 2

(b)(i) Mark scheme

- 1
- states only observable differences ;
- (differences) 2, 3 and 4 ;
- Any three from :
 - feature
 - Fig. 2.2
 - K1
 - area of vascular tissue

Solution 2

- larger
- smaller ;
- presence of trichomes
- absent
- present ;
- number of xylem vessels
- more
- less ;
- presence of endodermis
- absent

Solution 2

- present ;
- 4
- 9700/33
- October/November 2025

Solution 2

(c)(i) Mark scheme

- 1
- records a value for the length of the line $A - B$;
- 2
- shows the length of line $A - B$ divided by 35 to calculate actual length of line $A - B$;
- 3
- shows $\frac{1}{2}$ actual length of line $A - B$ squared and multiplied by ;
- 4

Solution 2

- correct answer ;
- 4

Solution 2

(c)(ii) Mark scheme

- 1
- take sections of the root from plants at different ages ;
- 2
- keep the species of the plants the same ;
- 3
- keep the variables for growing the plants the same ;
- 3

Question 2

9700/34 N25 ■ Q2 ■ 19 marks

2 L1 is a slide of a stained transverse section through a plant organ.

- (a) (i)** Draw a large plan diagram of the region on L1 indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

Use **one** ruled label line and label to identify **one** vascular bundle.

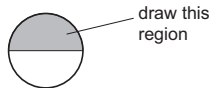


Fig. 2.1

Question 2

Question 2

Question 2

(ii) Observe the xylem vessel elements in the organ on **L1**.

Select a line of **four** adjacent xylem vessel elements.

Each xylem vessel element must touch at least **one** other xylem vessel element.

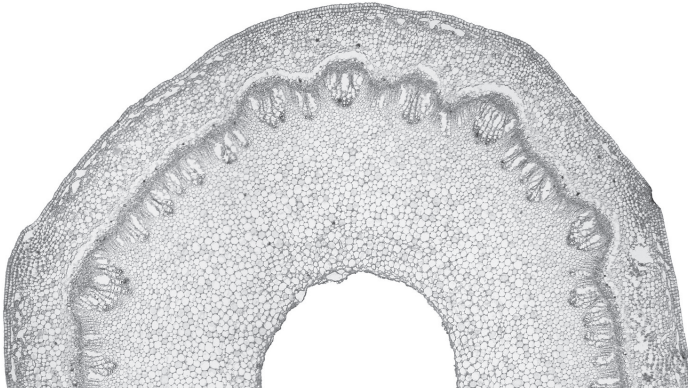
- Make a large drawing of this line of **four** xylem vessel elements.
- Use **one** ruled label line and label to identify the wall of **one** xylem vessel element.

Question 2

- (iii) Identify the plant organ on **L1** and give a reason for your answer. [5]

Question 2

- (b) Fig. 2.2 is a photomicrograph of a stained transverse section of the same organ from a different plant to L1.



Question 2



Question 2



Fig. 2.2

Identify **two** observable differences, other than colour, between the section on **L1** and the section in Fig. 2.2

Question 2

Section III, Pg. 2-2.

Question 2

Record these **two** observable differences in Table 2.1.

Table 2.1

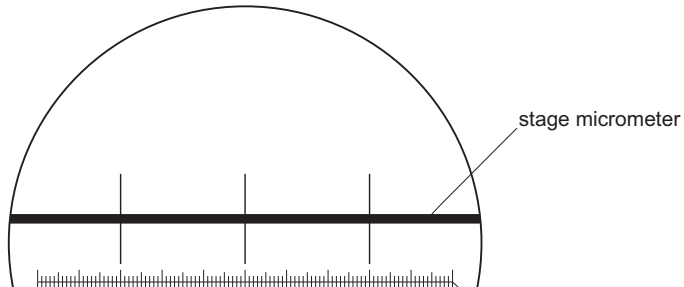
feature	L1	Fig. 2.2
1		
2		

Question 2

- (c) Fig. 2.3 shows a photomicrograph of a stage micrometer scale that is being used to calibrate an eyepiece graticule.

One division, on either the stage micrometer scale or the eyepiece graticule, is the distance between two adjacent lines.

The length of one division on the stage micrometer in Fig. 2.3 is 1.0 mm.



Question 2

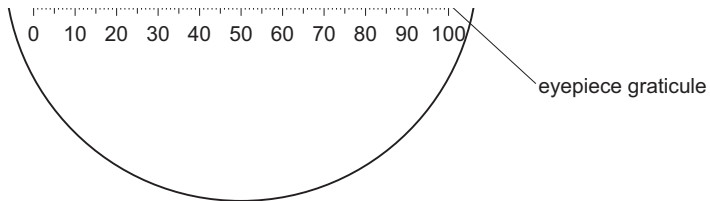


Fig. 2.3

- (i) Calculate the actual length of **one** eyepiece graticule unit shown in Fig. 2.3.

Give your answer in micrometres (μm).

Show your working.

Question 2

Question 2

[2]

Fig. 2.4 is the same photomicrograph as that shown in Fig. 2.2. This was taken with the same microscope and the same lenses used to take the photomicrograph in Fig. 2.3. The eyepiece graticule has been placed across the width of the tissue.



Question 2

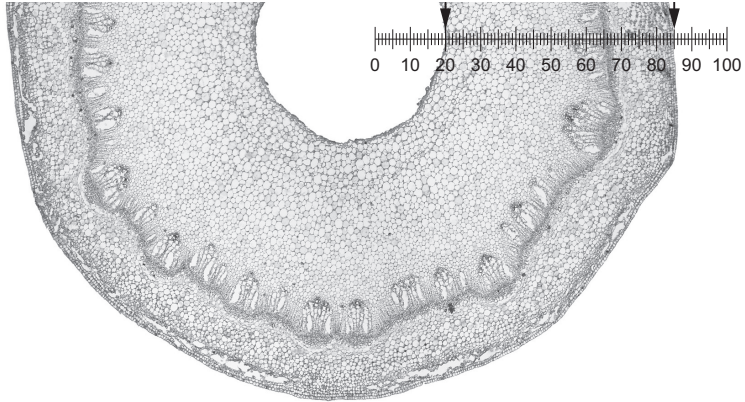


Fig. 2.4

Question 2

- (ii) Use your calibration of one eyepiece graticule unit from **(c)(i)** to calculate the actual width of the tissue between the arrows on Fig. 2.4.

Show your working and use appropriate units.

Question 2

[2]

- (iii) The width of the tissue in Fig. 2.4 varies. Suggest how you could more accurately calculate the width of the tissue.

Question 2

[Total: 19]

Solution 2

(a)(i) Mark scheme

- 1
- appropriate size and no shading ;
- 2
- draws correct section of the organ ;
- 3
- draws the correct pattern of vascular bundles and the correct proportions of large vascular bundles
- and no cells drawn ;

Solution 2

- 4
- draws two lines for the epidermis and trichomes ;
- 5
- label line and label to vascular bundle ;
- 5

Solution 2

(a)(ii) Mark scheme

- 1
- appropriate size and lines are sharp and continuous ;
- 2
- draws only four xylem vessel elements and each xylem vessel element touches at least one other xylem vessel
- element ;
- 3

Solution 2

- two lines around each xylem vessel element and three lines where xylem vessel elements touch ;
- 4
- draws correct shape of xylem vessel elements ;
- 5
- label line and label to the wall of one xylem vessel element ;
- 5

Solution 2

(a)(iii)

Mark scheme

- 1
- stem and reason ;
- 1
- 9700/34
- October/November 2025

Solution 2

(b) Mark scheme

- 1
- collects differences using only observable differences ;
- 2, 3 two observable differences ;;
- any two (correct differences) from:
 - feature
 - Fig. 2.2
 - shape
 - square

Solution 2

- circular ;
- vascular bundles
- at corners and between bulges
- in a ring ;
- vascular bundles
- large and small
- same size ;
- central tissue
- cells
- no cells ;

Solution 2

■ 3

Solution 2

(c)(i)

Mark scheme

- 1
- correct number of eyepiece graticule units ;
- 2
- shows division of eyepiece graticule units by one and multiplies by 1000 ;
- 2

Solution 2

(c)(ii)

Mark scheme

- 1
- correct measurement using eyepiece graticule units ;
- 2
- shows the answer from 2(c)(i) multiplied by the number of eyepiece graticule units ;
- 2

Solution 2

(c)(iii)

Mark scheme

- 1
- 3 measurements and calculate the mean ;
- 1